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OCT 05 2006

PATENT APPLICATION
Attorney Docket: 10031180-1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF APPEALS

Applicant: Mirkarimi, et al
Serial No.: 10/692,772
Filed: 10/24/2003
For: Method for Etching Smooth Sidewalls in III-V Based Compounds for Electro-Optical Devices
Group Art Unit: 1765
Examiner: Vinh, Lan

BRIEF FOR APPELLANT

Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from the decision of the Primary Examiner dated 07/11/2006, finally rejecting Claims 1-5, 10, 19 and 20 in the above-identified patent application.

I. REAL PARTY IN INTEREST

The real party in interest is Avago Technologies, LTD. having an address as indicated below.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to appellant, the appellant's legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in this pending appeal.

III. STATUS OF THE CLAIMS

10/05/2006 TL0111 02000014 503718 10692772
02 FC:1402 500.00 DA

Claims 1-5, 8-10, 19 and 20 are currently pending in the above-identified patent application. In the Office Action dated 7/11/2006, the Examiner rejected Claims 1-5, 10, 19 and 20 and indicated that the Action was final. Claims 8, 9, and 11-16 are allowed.

IV. STATUS OF AMENDMENTS

An amendment under 37 C.F.R. 1.116 was filed on 08/15/2006. In an advisory action dated 08/29/2006, the Examiner stated that Claims 8-9 and 11-16 were allowed and that Claims 1-5, 10, 19, and 20 were rejected. The Examiner also indicated that the amendment would be entered. The attached claims reflect the amendment in question.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

With respect to Claim 1, the present invention includes a method for etching a III-V based compound comprising creating a mask on the III-V based compound (element 130 in Figures 1a-1c, and discussion thereof on page 3, starting at line 3). The III-V based compound and the mask are placed into a reactor having a pressure between about 2 mTorr to about 20 mTorr (See Figure 3 and the discussion thereof starting at page 4, line 21). First and second gases are introduced into the reactor. The first gas is chosen from HBr, HI, and IBr and the second gas is BCl₃. The III-V based compound is exposed to a gas plasma comprising the first and the second gas to etch smooth high aspect ratio sidewalls, wherein BCl₃ is present in the reactor at a concentration of about 5 percent to about 75 percent by volume (See claims 1 and 7 as originally filed). With respect to Claim 2, the III-V based compound comprises indium (page 4, first paragraph). With respect to Claim 3, the gas plasma is generated using a reactive ion etching system (See discussion of Figure 3 and the original claims). With respect to Claim 4, the gas plasma is generated using a combined reactive ion etching and inductively coupled plasma system (See discussion of Figure 3 and the original claims). With respect to Claim 5, a first radio frequency generator is operated in the range from about 0 to 200 watts and a second radio frequency generator is operated in the range from about 50-800 watts (See discussion of Figure 3, and the original claims). With respect to Claim 10, the III-V based compound is heated to an initial temperature of about 60°C (See discussion of Figure 3 and the original claims). With respect to Claim 18, the first gas can be replaced by a gas from group VII gases species (See page 4, lines 1-4). With respect to Claim 20, the plasma is a

three gas plasma comprising BCl_3 , CH_4 , and H_2 and the concentration of CH_4 to H_2 is about 2:1 (See page 4, lines 1-7).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Rejection of Claims 1-5, 10, and 19 under 35 U.S.C. 103(a) as being unpatentable over Tanabe, *et al* (hereafter "Tanabe") (US 6,893,971) in view of Shul, *et al* (hereafter "Shul").

B. Rejection of Claim 20 under 35 U.S.C. 103(a) as being unpatentable over Shul in view of Demmin, *et al* (US6.635,185) (hereafter "Demmin").

VII. ARGUMENT

A. Examiner's Burden

To sustain a rejection under 35 U.S.C. 103, the Examiner must show that the combined references teach each of the elements of the claim or that there is some motivation in the art for altering one of the teachings to arrive at the combined set of teachings. "The mere fact that a reference could be modified to produce the patented invention would not make the modification obvious unless it is suggested by the prior art." (*Libbey-Owens-Ford v. BOC Group*, 4 USPQ 2d 1097, 1103). "When the PTO asserts that there is an explicit or implicit teaching or suggestion in the prior art, it must indicate where such a teaching or suggestion appears in the reference" (*In re Rijckaert*, 28 USPQ2d, 1955, 1957). In addition, the Examiner must show that there is some motivation in the art that would cause someone of ordinary skill to combine the references, and that in making the combination, there was a reasonable expectation of success. Where the claimed subject matter has been rejected as obvious in view of a combination of prior art references, a proper analysis under section 103 requires, *inter alia*, consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should make the claimed composition or device, or carry out the claimed process; and (2) whether the prior art would also have revealed that in so making or carrying out, those of ordinary skill would have a reasonable expectation of success. Both the suggestion and the reasonable expectation of success must be founded in the prior art, not in the applicant's disclosure. *In re Vaeck*, 20 USPQ2d 1438, 1442(CAFC 1991).

B. Rejection of Claims 1-5 and 10

Claim 1 requires an etching gas mixture having a first gas chosen from the group consisting of HBr, HI, and IBr and a second gas, BCl₃. The claim also requires that the BCl₃ be present in the reactor at a concentration of about 5 percent to about 75 percent by volume in the reactor. The Examiner looks to Tanabe as teaching a combination of gases that meet the first limitation. However, the Examiner admits that Tanabe does not teach the concentration limit in question. The Examiner looks to Shul as teaching a combination of etching gases that includes BCl₃ in which the flow rate into the reactor satisfies the concentration range. The Examiner maintains that it would be obvious to import the gas concentration of Shul into the system of Tanabe.

First, Tanabe does not teach any example of an etching gas consisting of HBr and BCl₃. Tanabe states that such an etching combination can be used. However, all of the examples given in Tanabe involve HI and He. Shul teaches a 5 gas etching system based on BCl₃, CH₄, Cl₂, H₂, and Ar in which the flow rate of BCl₃ into the reactor chamber would satisfy the concentration limitation of Claim 1. However, it must be noted that Shul does not teach a gas from the relevant group. Shul also teaches that the results are highly dependent flow rates of the gases and various other factors (col. 6, lines 22-33). Given the highly variable nature of the results as disclosed by Shul and the fact that the gas mixtures are different in the two systems, one would not have a reasonable expectation of success in importing the gas flow rate of BCl₃ taught in Shul into the system of Tanabe for the BCl₃ embodiment disclosed there.

Second, the concentrations disclosed in Shul are the concentrations of the gases in the input to the reactor, not the concentrations of the gases in the reactor. The gases are consumed at different rates in the reactor. Hence, the concentration of the gases in the reactor cannot be inferred from the input concentrations absent additional information that is not provided in the references. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claim 1 or the claims dependent therefrom.

C. Rejection of Claim 19.

Claim 19 requires an etching gas mixture having a first gas chosen from the group consisting of VII gases and a second gas, BCl₃. The claim also requires that the BCl₃ be

present in the reactor at a concentration of about 5 percent to about 75 percent by volume in the reactor. The Examiner looks to the 5 gas combination taught in Shul as satisfying the claim limitations. As noted above, the concentration range in the input to the reactor taught in Shul does not provide information as to the concentration in the reactor as required by the claim. Hence, Applicant submits that the Examiner has not made *prima facie* case for obviousness with respect to Claim 19.

D. Rejection of Claim 20

Claim 20 requires a three gas mixture (BCl_3 , CH_4 , and H_2) in which H_2/CH_4 is less than 1 and CH_4/H_2 is about 2:1. The Examiner looks to Shul as teaching a 5 gas mixture that includes the three gases in question. The Examiner admits that Shul does not teach the ratio limitation of Claim 20. The Examiner looks to Demmin as teaching that gas flow affects the results and also to Shul as teaching that the relative flow rate and concentration are important controlling variables, and hence, the flow rate limitation is merely a matter of finding the optimum value of a variable.

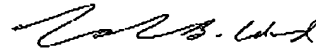
First, Shul teaches that the ratio of CH_4/H_2 is about 2/20 in the only example provided therein for the 5 gas system in question (col. 6, lines 45-56). Hence, if anything, Shul teaches away from the claimed limitation. Second, as noted above, Shul teaches that the results are highly dependent on a large number of factors including the gas flow rates, temperature, specific substrates, etc. Hence, there are an overwhelming number of variables, and combinations thereof, to optimize. Absent the teachings of the present application, one of ordinary skill would not arrive at the claimed combination without undue experimentation. Hence, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claim 20.

VIII. CONCLUSION

Appellants respectfully submit that for the reasons of fact and law argued herein, the decision of the Examiner in finally rejecting Claims 1-5, 10, 19 and 20 should be reversed.

I hereby certify that this paper (along with any others attached hereto) is being sent in triplicate via facsimile to fax number: 571-273-8300

Respectfully Submitted,



Calvin B. Ward
Registration No. 30,896
Date: Oct. 5, 2006

Avago Technologies, LTD.
P.O. Box 1920
Denver, CO 80201-1920
Telephone (925) 855-0413
Telefax (925)855-9214

APPENDIXRECEIVED
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1. A method for etching a III-V based compound comprising:
creating a mask on said III-V based compound;
placing said III-V based compound and said mask into a reactor having a pressure between about 2 mTorr to about 20 mTorr;
introducing a first gas chosen from HBr, HI, and IBr into said reactor;
introducing second gas of BCl₃ into said reactor; and
exposing said III-V based compound to a gas plasma comprising said first and said second gas to etch smooth high aspect ratio sidewalls, wherein BCl₃ is present in said reactor at a concentration of about 5 percent to about 75 percent by volume.
2. The method of Claim 1 wherein said III-V based compound comprises indium.
3. The method of Claim 1 wherein said gas plasma is generated using a reactive ion etching system.
4. The method of Claim 1 wherein said gas plasma is generated using a combined reactive ion etching and inductively coupled plasma system.
5. The method of Claim 4 wherein a first radio frequency generator is operated in the range from about 0 to 200 watts and a second radio frequency generator is operated in the range from about 50-800 watts.
10. The method of Claim 1 wherein said III-V based compound is heated to an initial temperature of about 60°C.
19. A method for etching a III-V based compound comprising:
creating a mask on said III-V based compound;

placing said III-V based compound and said mask into a reactor having a pressure between about 2 mTorr to about 20 mTorr;
introducing a first gas chosen from group VII gaseous species into said reactor;
introducing second gas of BCl_3 into said reactor; and
exposing said III-V based compound to a gas plasma comprising said first and said second gas to etch smooth high aspect ratio sidewalls, wherein BCl_3 is present in said reactor at a concentration of about 5 percent to about 75 percent by volume.

20. A method for etching a III-V based compound comprising:
creating a mask on said III-V based compound;
placing said III-V based compound and said mask into a reactor having a pressure between about 2 mTorr to about 20 mTorr;
introducing a first gas of BCl_3 into said reactor;
introducing a second gas of CH_4 ;
introducing a third gas of H_2 such that the ratio of said third gas to said second gas is less than one; and
exposing said III-V based compound to a gas plasma comprising said first, second and third gas to etch smooth high aspect ratio sidewalls, wherein the ratio of said second gas to said third gas is about 2:1.

Evidence Appendix

none

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Related Proceedings Appendix

none

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V. SUMMARY OF THE CLAIMED SUBJECT MATTER

With respect to Claim 1, the present invention includes a method for etching a III-V based compound comprising creating a mask on the III-V based compound (element 130 in Figures 1a-1c, and discussion thereof on page 3, starting at line 3). The III-V based compound and the mask are placed into a reactor having a pressure between about 2 mTorr to about 20 mTorr (See Figure 3 and the discussion thereof starting at page 4, line 21). First and second gases are introduced into the reactor. The first gas is chosen from HBr, HI, and IBr and the second gas is BCl₃. The III-V based compound is exposed to a gas plasma comprising the first and the second gas to etch smooth high aspect ratio sidewalls, wherein BCl₃ is present in the reactor at a concentration of about 5 percent to about 75 percent by volume (See claims 1 and 7 as originally filed). With respect to Claim 2, the III-V based compound comprises indium (page 4, first paragraph). With respect to Claim 3, the gas plasma is generated using a reactive ion etching system (See discussion of Figure 3 and the original claims). With respect to Claim 4, the gas plasma is generated using a combined reactive ion etching and inductively coupled plasma system (See discussion of Figure 3 and the original claims). With respect to Claim 5, a first radio frequency generator is operated in the range from about 0 to 200 watts and a second radio frequency generator is operated in the range from about 50-800 watts (See discussion of Figure 3, and the original claims). With respect to Claim 10, the III-V based compound is heated to an initial temperature of about 60°C (See discussion of Figure 3 and the original claims). With respect to Claim 18, the first gas can be replaced by a gas from group VII gases species (See page 4, lines 1-4). With respect to Claim 20, the plasma is a

three gas plasma comprising BCl_3 , C_2F_4 , and H_2 and the concentration of CH_4 to H_2 is about 2:1 (See page 4, lines 1-7).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Rejection of Claims 1-5, 10, and 19 under 35 U.S.C. 103(a) as being unpatentable over Tanabe, *et al* (hereafter "Tanabe") (US 6,893,971) in view of Shul, *et al* (hereafter "Shul").

B. Rejection of Claim 20 under 35 U.S.C. 103(a) as being unpatentable over Shul in view of Demmin, *et al* (US6.635,185) (hereafter "Demmin").

VII. ARGUMENT

A. Examiner's Burden

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B. Rejection of Claims 1-5 and 10

Claim 1 requires an etching gas mixture having a first gas chosen from the group consisting of HBr, HI, and IBr and a second gas, BCl₃. The claim also requires that the BCl₃ be present in the reactor at a concentration of about 5 percent to about 75 percent by volume in the reactor. The Examiner looks to Tanabe as teaching a combination of gases that meet the first limitation. However, the Examiner admits that Tanabe does not teach the concentration limit in question. The Examiner looks to Shul as teaching a combination of etching gases that includes BCl₃ in which the flow rate into the reactor satisfies the concentration range. The Examiner maintains that it would be obvious to import the gas concentration of Shul into the system of Tanabe.

First, Tanabe does not teach any example of an etching gas consisting of HBr and BCl₃. Tanabe states that such an etching combination can be used. However, all of the examples given in Tanabe involve HI and He. Shul teaches a 5 gas etching system based on BCl₃, CH₄, Cl₂, H₂, and Ar in which the flow rate of BCl₃ into the reactor chamber would satisfy the concentration limitation of Claim 1. However, it must be noted that Shul does not teach a gas from the relevant group. Shul also teaches that the results are highly dependent flow rates of the gases and various other factors (col. 6, lines 22-33). Given the highly variable nature of the results as disclosed by Shul and the fact that the gas mixtures are different in the two systems, one would not have a reasonable expectation of success in importing the gas flow rate of BCl₃ taught in Shul into the system of Tanabe for the BCl₃ embodiment disclosed there.

Second, the concentrations disclosed in Shul are the concentrations of the gases in the input to the reactor, not the concentrations of the gases in the reactor. The gases are consumed at different rates in the reactor. Hence, the concentration of the gases in the reactor cannot be inferred from the input concentrations absent additional information that is not provided in the references. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claim 1 or the claims dependent therefrom.

C. Rejection of Claim 19.

Claim 19 requires an etching gas mixture having a first gas chosen from the group consisting of VII gases and a second gas, BCl₃. The claim also requires that the BCl₃ be

present in the reactor at a concentration of about 5 percent to about 75 percent by volume in the reactor. The Examiner looks to the 5 gas combination taught in Shul as satisfying the claim limitations. As noted above, the concentration range in the input to the reactor taught in Shul does not provide information as to the concentration in the reactor as required by the claim. Hence, Applicant submits that the Examiner has not made *prima facie* case for obviousness with respect to Claim 19.

D. Rejection of Claim 20

Claim 20 requires a three gas mixture (BCl_3 , CH_4 , and H_2) in which H_2/CH_4 is less than 1 and CH_4/H_2 is about 2:1. The Examiner looks to Shul as teaching a 5 gas mixture that includes the three gases in question. The Examiner admits that Shul does not teach the ratio limitation of Claim 20. The Examiner looks to Demmin as teaching that gas flow affects the results and also to Shul as teaching that the relative flow rate and concentration are important controlling variables, and hence, the flow rate limitation is merely a matter of finding the optimum value of a variable.

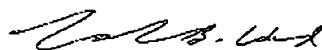
First, Shul teaches that the ratio of CH_4/H_2 is about 2/20 in the only example provided therein for the 5 gas system in question (col. 6, lines 45-56). Hence, if anything, Shul teaches away from the claimed limitation. Second, as noted above, Shul teaches that the results are highly dependent on a large number of factors including the gas flow rates, temperature, specific substrates, etc. Hence, there are an overwhelming number of variables, and combinations thereof, to optimize. Absent the teachings of the present application, one of ordinary skill would not arrive at the claimed combination without undue experimentation. Hence, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claim 20.

VIII. CONCLUSION

Appellants respectfully submit that for the reasons of fact and law argued herein, the decision of the Examiner in finally rejecting Claims 1-5, 10, 19 and 20 should be reversed.

I hereby certify that this paper (along with any others attached hereto) is being sent in triplicate via facsimile to fax number: 571-273-8300

Respectfully Submitted,



Calvin B. Ward
Registration No. 30,896
Date: Oct. 5, 2006

Avago Technologies, LTD.
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Denver, CO 80201-1920
Telephone (925) 855-0413
Telefax (925)855-9214

APPENDIXRECEIVED
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1. A method for etching a III-V based compound comprising:
creating a mask on said III-V based compound;
placing said III-V based compound and said mask into a reactor having a pressure between about 2 mTorr to about 20 mTorr;
introducing a first gas chosen from IBr, HI, and IBr into said reactor;
introducing second gas of BCl₃ into said reactor; and
exposing said III-V based compound to a gas plasma comprising said first and said second gas to etch smooth high aspect ratio sidewalls, wherein BCl₃ is present in said reactor at a concentration of about 5 percent to about 75 percent by volume.
2. The method of Claim 1 wherein said III-V based compound comprises indium.
3. The method of Claim 1 wherein said gas plasma is generated using a reactive ion etching system.
4. The method of Claim 1 wherein said gas plasma is generated using a combined reactive ion etching and inductively coupled plasma system.
5. The method of Claim 4 wherein a first radio frequency generator is operated in the range from about 0 to 200 watts and a second radio frequency generator is operated in the range from about 50-800 watts.
10. The method of Claim 1 wherein said III-V based compound is heated to an initial temperature of about 60°C.
19. A method for etching a III-V based compound comprising:
creating a mask on said III-V based compound;

placing said III-V based compound and said mask into a reactor having a pressure between about 2 mTorr to about 20 mTorr;
introducing a first gas chosen from group VII gaseous species into said reactor;
introducing second gas of BCl_3 into said reactor; and
exposing said III-V based compound to a gas plasma comprising said first and said second gas to etch smooth high aspect ratio sidewalls, wherein BCl_3 is present in said reactor at a concentration of about 5 percent to about 75 percent by volume.

20. A method for etching a III-V based compound comprising:
creating a mask on said III-V based compound;
placing said III-V based compound and said mask into a reactor having a pressure between about 2 mTorr to about 20 mTorr;
introducing a first gas of BCl_3 into said reactor;
introducing a second gas of CH_4 ;
introducing a third gas of H_2 such that the ratio of said third gas to said second gas is less than one; and
exposing said III-V based compound to a gas plasma comprising said first, second and third gas to etch smooth high aspect ratio sidewalls, wherein the ratio of said second gas to said third gas is about 2:1.

Evidence Appendix

none

Related Proceedings Appendix

none

AVAGO TECHNOLOGIES, LTD.
P.O. Box 1920
Denver, Colorado 80201-1920

ATTORNEY DOCKET NO. 10031180-1

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Examiner: Vinh, Lan

Filing Date: October 24, 2003

Group Art Unit: 1765

Title: Method for Etching Smooth Sidewalls in III-V Based Compounds for Electro-Optical Devices

COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria VA 22313-1450

TRANSMITTAL LETTER FOR RESPONSE/AMENDMENT

Sir:

Transmitted herewith is/are the following in the above-identified application:

- ☐ Response/Amendment ☐ Petition to extend time to respond
☐ New fee as calculated below ☐ Supplemental Declaration
☐ No additional fee (Address envelope to "Mail Stop Amendments")
☒ Other: Appeal Brief (Fee \$500)

CLAIMS AS AMENDED BY OTHER THAN A SMALL ENTITY						
(1) FOR	(2) CLAIMS REMAINING AFTER AMENDMENT	(3) NUMBER EXTRA	(4) HIGHEST NUMBER PREVIOUSLY PAID FOR	(5) PRESENT EXTRA	(6) RATE	(7) ADDITIONAL FEES
TOTAL CLAIMS		MINUS		= 0	X 50	\$ 0
INDEP. CLAIMS		MINUS		= 0	X 200	\$ 0
<input type="checkbox"/> FIRST PRESENTATION OF A MULTIPLE DEPENDENT CLAIM					+ 360	\$ 0
EXTENSION FEE	1 st MONTH 120.00 <input type="checkbox"/>	2 nd MONTH 450.00 <input type="checkbox"/>	3 rd MONTH 1020.00 <input type="checkbox"/>	4 th MONTH 1590.00 <input type="checkbox"/>		\$ 0
OTHER FEES						\$ 500
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT						\$ 500

Charge \$500 to Deposit Account 50-3718. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 50-3718 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 50-3718 under 37 CFR 1.16, 1.17, 1.19, 1.20 and 1.21. A duplicate copy of this transmittal letter is enclosed.

Respectfully submitted,

Mirkarimi, et al

By

Calvin B. Ward
Attorney/Agent for Applicant(s)

Reg. No. 30,896

Date: Oct. 5, 2006

Telephone No. 925-855-0413

I hereby certify that this paper is being facsimile transmitted to the Patent and Trademark Office on the date shown below:

Date of facsimile: Oct. 5, 2006

Typed Name: Calvin B. Ward

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Rev 10/04 (TransAmd)

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An amendment under 37 C.F.R. 1.116 was filed on 08/15/2006. In an advisory action dated 08/29/2006, the Examiner stated that Claims 8-9 and 11-16 were allowed and that Claims 1-5, 10, 19, and 20 were rejected. The Examiner also indicated that the amendment would be entered. The attached claims reflect the amendment in question.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

With respect to Claim 1, the present invention includes a method for etching a III-V based compound comprising creating a mask on the III-V based compound (element 130 in Figures 1a-1c, and discussion thereof on page 3, starting at line 3). The III-V based compound and the mask are placed into a reactor having a pressure between about 2 mTorr to about 20 mTorr (See Figure 3 and the discussion thereof starting at page 4, line 21). First and second gases are introduced into the reactor. The first gas is chosen from HBr, HI, and IBr and the second gas is BCl₃. The III-V based compound is exposed to a gas plasma comprising the first and the second gas to etch smooth high aspect ratio sidewalls, wherein BCl₃ is present in the reactor at a concentration of about 5 percent to about 75 percent by volume (See claims 1 and 7 as originally filed). With respect to Claim 2, the III-V based compound comprises indium (page 4, first paragraph). With respect to Claim 3, the gas plasma is generated using a reactive ion etching system (See discussion of Figure 3 and the original claims). With respect to Claim 4, the gas plasma is generated using a combined reactive ion etching and inductively coupled plasma system (See discussion of Figure 3 and the original claims). With respect to Claim 5, a first radio frequency generator is operated in the range from about 0 to 200 watts and a second radio frequency generator is operated in the range from about 50-800 watts (See discussion of Figure 3, and the original claims). With respect to Claim 10, the III-V based compound is heated to an initial temperature of about 60°C (See discussion of Figure 3 and the original claims). With respect to Claim 18, the first gas can be replaced by a gas from group VII gases species (See page 4, lines 1-4). With respect to Claim 20, the plasma is a

three gas plasma comprising BCl_3 , CH_4 , and H_2 and the concentration of CH_4 to H_2 is about 2:1 (See page 4, lines 1-7).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Rejection of Claims 1-5, 10, and 19 under 35 U.S.C. 103(a) as being unpatentable over Tanabe, *et al* (hereafter "Tanabe") (US 6,893,971) in view of Shul, *et al* (hereafter "Shul").

B. Rejection of Claim 20 under 35 U.S.C. 103(a) as being unpatentable over Shul in view of Demmin, *et al* (US6.635,185) (hereafter "Demmin").

VII. ARGUMENT

A. Examiner's Burden

To sustain a rejection under 35 U.S.C. 103, the Examiner must show that the combined references teach each of the elements of the claim or that there is some motivation in the art for altering one of the teachings to arrive at the combined set of teachings. "The mere fact that a reference could be modified to produce the patented invention would not make the modification obvious unless it is suggested by the prior art." (*Libbey-Owens-Ford v. BOC Group*, 4 USPQ 2d 1097, 1103). "When the PTO asserts that there is an explicit or implicit teaching or suggestion in the prior art, it must indicate where such a teaching or suggestion appears in the reference" (*In re Rijckaert*, 28 USPQ2d, 1955, 1957). In addition, the Examiner must show that there is some motivation in the art that would cause someone of ordinary skill to combine the references, and that in making the combination, there was a reasonable expectation of success. Where the claimed subject matter has been rejected as obvious in view of a combination of prior art references, a proper analysis under section 103 requires, *inter alia*, consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should make the claimed composition or device, or carry out the claimed process; and (2) whether the prior art would also have revealed that in so making or carrying out, those of ordinary skill would have a reasonable expectation of success. Both the suggestion and the reasonable expectation of success must be founded in the prior art, not in the applicant's disclosure. *In re Vaeck*, 20 USPQ2d 1438, 1442(CAFC 1991).

B. Rejection of Claims 1-5 and 10

Claim 1 requires an etching gas mixture having a first gas chosen from the group consisting of HBr, HI, and IBr and a second gas, BCl_3 . The claim also requires that the BCl_3 be present in the reactor at a concentration of about 5 percent to about 75 percent by volume in the reactor. The Examiner looks to Tanabe as teaching a combination of gases that meet the first limitation. However, the Examiner admits that Tanabe does not teach the concentration limit in question. The Examiner looks to Shul as teaching a combination of etching gases that includes BCl_3 in which the flow rate into the reactor satisfies the concentration range. The Examiner maintains that it would be obvious to import the gas concentration of Shul into the system of Tanabe.

First, Tanabe does not teach any example of an etching gas consisting of HBr and BCl_3 . Tanabe states that such an etching combination can be used. However, all of the examples given in Tanabe involve HI and He. Shul teaches a 5 gas etching system based on BCl_3 , CH_4 , Cl_2 , H_2 , and Ar in which the flow rate of BCl_3 into the reactor chamber would satisfy the concentration limitation of Claim 1. However, it must be noted that Shul does not teach a gas from the relevant group. Shul also teaches that the results are highly dependent flow rates of the gases and various other factors (col. 6, lines 22-33). Given the highly variable nature of the results as disclosed by Shul and the fact that the gas mixtures are different in the two systems, one would not have a reasonable expectation of success in importing the gas flow rate of BCl_3 taught in Shul into the system of Tanabe for the BCl_3 embodiment disclosed there.

Second, the concentrations disclosed in Shul are the concentrations of the gases in the input to the reactor, not the concentrations of the gases in the reactor. The gases are consumed at different rates in the reactor. Hence, the concentration of the gases in the reactor cannot be inferred from the input concentrations absent additional information that is not provided in the references. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claim 1 or the claims dependent therefrom.

C. Rejection of Claim 19.

Claim 19 requires an etching gas mixture having a first gas chosen from the group consisting of VII gases and a second gas, BCl_3 . The claim also requires that the BCl_3 be

present in the reactor at a concentration of about 5 percent to about 75 percent by volume in the reactor. The Examiner looks to the 5 gas combination taught in Shul as satisfying the claim limitations. As noted above, the concentration range in the input to the reactor taught in Shul does not provide information as to the concentration in the reactor as required by the claim. Hence, Applicant submits that the Examiner has not made *prima facie* case for obviousness with respect to Claim 19.

D. Rejection of Claim 20

Claim 20 requires a three gas mixture (BCl_3 , CH_4 , and H_2) in which H_2/CH_4 is less than 1 and CH_4/H_2 is about 2:1. The Examiner looks to Shul as teaching a 5 gas mixture that includes the three gases in question. The Examiner admits that Shul does not teach the ratio limitation of Claim 20. The Examiner looks to Demmin as teaching that gas flow affects the results and also to Shul as teaching that the relative flow rate and concentration are important controlling variables, and hence, the flow rate limitation is merely a matter of finding the optimum value of a variable.

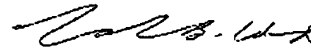
First, Shul teaches that the ratio of CH_4/H_2 is about 2/20 in the only example provided therein for the 5 gas system in question (col. 6, lines 45-56). Hence, if anything, Shul teaches away from the claimed limitation. Second, as noted above, Shul teaches that the results are highly dependent on a large number of factors including the gas flow rates, temperature, specific substrates, etc. Hence, there are an overwhelming number of variables, and combinations thereof, to optimize. Absent the teachings of the present application, one of ordinary skill would not arrive at the claimed combination without undue experimentation. Hence, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claim 20.

VIII. CONCLUSION

Appellants respectfully submit that for the reasons of fact and law argued herein, the decision of the Examiner in finally rejecting Claims 1-5, 10, 19 and 20 should be reversed.

I hereby certify that this paper (along with any others attached hereto) is being sent in triplicate via facsimile to fax number: 571-273-8300

Respectfully Submitted,



Calvin B. Ward
Registration No. 30,896
Date: Oct. 5, 2006

Avago Technologies, LTD.
P.O. Box 1920
Denver, CO 80201-1920
Telephone (925) 855-0413
Telefax (925)855-9214

APPENDIXRECEIVED
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THE CLAIMS ON APPEAL:

1. A method for etching a III-V based compound comprising:
creating a mask on said III-V based compound;
placing said III-V based compound and said mask into a reactor having a pressure between about 2 mTorr to about 20 mTorr;
introducing a first gas chosen from HBr, HI, and IBr into said reactor;
introducing second gas of BCl₃ into said reactor; and
exposing said III-V based compound to a gas plasma comprising said first and said second gas to etch smooth high aspect ratio sidewalls, wherein BCl₃ is present in said reactor at a concentration of about 5 percent to about 75 percent by volume.
2. The method of Claim 1 wherein said III-V based compound comprises indium.
3. The method of Claim 1 wherein said gas plasma is generated using a reactive ion etching system.
4. The method of Claim 1 wherein said gas plasma is generated using a combined reactive ion etching and inductively coupled plasma system.
5. The method of Claim 4 wherein a first radio frequency generator is operated in the range from about 0 to 200 watts and a second radio frequency generator is operated in the range from about 50-800 watts.
10. The method of Claim 1 wherein said III-V based compound is heated to an initial temperature of about 60°C.
19. A method for etching a III-V based compound comprising:
creating a mask on said III-V based compound;

placing said III-V based compound and said mask into a reactor having a pressure between about 2 mTorr to about 20 mTorr;
introducing a first gas chosen from group VII gaseous species into said reactor;
introducing second gas of BCl_3 into said reactor; and
exposing said III-V based compound to a gas plasma comprising said first and said second gas to etch smooth high aspect ratio sidewalls, wherein BCl_3 is present in said reactor at a concentration of about 5 percent to about 75 percent by volume.

20. A method for etching a III-V based compound comprising:
creating a mask on said III-V based compound;
placing said III-V based compound and said mask into a reactor having a pressure between about 2 mTorr to about 20 mTorr;
introducing a first gas of BCl_3 into said reactor;
introducing a second gas of CH_4 ;
introducing a third gas of H_2 such that the ratio of said third gas to said second gas is less than one; and
exposing said III-V based compound to a gas plasma comprising said first, second and third gas to etch smooth high aspect ratio sidewalls, wherein the ratio of said second gas to said third gas is about 2:1.

Evidence Appendix

none

Related Proceedings Appendix

none